

What is claimed is:

1. A miniature microscope objective, comprising at least three miniature lenses with outer diameters less than 5 mm and including from object to image at least a first positive lens, a second positive lens, and a third lens, and having a numerical aperture (NA) greater than 0.4 and no more than approximately 0.9, and wherein over a range of visible wavelengths ( $\lambda$ ) including blue, green and red wavelengths of approximately 165 nm or more, said miniature objective having an image size variation less than an image sampling distance.
2. The miniature objective of claim 1, the miniature objective having a magnification variation  $\Delta M/M$  of less than substantially 1.5%.
3. The miniature objective of claim 2, the objective including at least four lenses including a fourth lens on the image side of the third lens.
4. The miniature objective of claim 3, further comprising a diffractive surface, wherein the miniature objective is corrected over a bandwidth of more than substantially 10 nm centered at any wavelength over the visible spectrum.
5. The miniature objective of claim 3, wherein over said range of visible wavelengths ( $\lambda$ ) including blue, green and red wavelengths of approximately 165 nm or more, said miniature objective having a magnification variation resulting in image size variation less than image sampling distance.
6. The miniature objective of claim 3, at least one of said third and fourth lenses comprising a negative lens.

7. The miniature objective of claim 3, said first lens comprising a plano-convex lens, said second lens comprising a bi-convex lens and said third and fourth lenses comprising meniscus lenses.
8. The miniature objective of claim 2, wherein changes in image size over said range of visible wavelengths are less than 5 microns.
9. The miniature objective of claim 2, wherein a ratio of change in image size to wavelength over said wavelength range is less than 25.
10. The miniature objective of claim 2, wherein at least one surface of said lenses of said miniature objective has a conic departure coefficient of magnitude around 0.2 or more.
11. The miniature objective of claim 10, wherein at least one other surface of said lenses of said miniature objective has a non-zero 4th order aspheric departure coefficient.
12. The miniature objective of claim 11, wherein said at least one other surface has a non-zero 6th order aspheric departure coefficient.
13. The miniature objective of claim 10, wherein at least a second surface of said lenses of said miniature objective has a conic departure coefficient of magnitude around 1.0.
14. The miniature objective of claim 13, wherein at least a third surface of said lenses of said miniature objective has a conic departure coefficient of magnitude around 1.4.

15. The miniature objective of claim 14, wherein at least a fourth surface of said lenses of said miniature objective has a conic departure coefficient of magnitude around 2.2.
16. The miniature objective of claim 3, the field of view (FOV) being substantially 220  $\mu\text{m}$  or more.
17. The miniature objective of claim 16, the outer diameter (OD) being substantially 2 mm or less, and the ratio of FOV to OD thereby being 0.11 or more.
18. The miniature objective of claim 2, the outer diameter (OD) being less than substantially 2 mm.
19. The miniature objective of claim 3, NA being more than 0.6.
20. The miniature objective of claim 2, the field of view (FOV) being substantially 240  $\mu\text{m}$  or more.
21. The miniature objective of Claim 3, further comprising a diffractive surface, and wherein the miniature objective is corrected over a bandwidth of more than substantially 10 nm and can operate at any center wavelength over the visible spectrum.
22. The miniature objective of Claim 21, wherein the diffractive surface is disposed on the front surface of the second positive lens facing the object.
23. The miniature objective of claim 2, further comprising at least two diffractive surfaces disposed on surfaces of lenses of said objective.
24. The miniature objective of claim 3, wherein each lens comprises a low-dispersion, crown-like material.

25. The miniature objective of claim 3, wherein distortion is less than 0.5% at an extreme field position.
26. The miniature objective of claim 2, said third lens comprising a negative lens.
27. The miniature objective of claim 26, further comprising a fourth positive lens.
28. The miniature objective of claim 2, said first lens comprising a plano-convex lens, said second lens comprising a bi-convex lens, and said third lens comprising a meniscus-type lens.
29. The miniature objective of claim 28, further comprising a fourth meniscus-type lens.
30. The miniature objective of claim 28, said third lens comprising a negative lens.
31. A miniature microscope objective, comprising at least three miniature lenses with outer diameters less than 5 mm and including from object to image a first positive lens, a second positive lens, a third lens, and a fourth lens, and having a numerical aperture (NA) greater than 0.4 and no more than approximately 0.9, and wherein said objective further comprises a diffractive surface such that the miniature objective is corrected over a bandwidth of more than substantially 10 nm.
32. The miniature objective of claim 31, comprising at least four lenses.
33. The miniature objective of claim 32, wherein over said range of visible wavelengths ( $\lambda$ ) including blue, green and red wavelengths of approximately 165 nm or more, said miniature objective having a magnification variation  $\Delta M/M$  of less than substantially 1.0%.

34. The miniature objective of claim 31, said third lens of said miniature objective comprising a negative lens.
35. The miniature objective of claim 34, further comprising a fourth positive lens.
36. The miniature objective of claim 31, said first lens comprising a plano-convex lens, said second lens comprising a bi-convex lens and said third lens comprising a meniscus-type lens.
37. The miniature objective of claim 32, wherein at least one surface of said lenses of said miniature objective has a conic departure coefficient of magnitude around 1.4 or more.
38. The miniature objective of claim 37, wherein at least a second surface of said lenses of said miniature objective has a conic departure coefficient of magnitude around 2.2 or more.
39. The miniature objective of claim 32, wherein at least one surface having a conic departure coefficient of magnitude around 2.2 or more.
40. The miniature objective of claim 32, the field of view (FOV) being substantially 220  $\mu\text{m}$  or more.
41. The miniature objective of claim 40, the outer diameter (OD) being substantially 2 mm or less, and the ratio of FOV to OD thereby being 0.11 or more.
42. The miniature objective of claim 32, the outer diameter (OD) being substantially 2 mm or less.

43. The miniature objective of claim 32, NA being more than substantially 0.6.
44. The miniature objective of Claim 32, wherein the diffractive surface is disposed on the front surface of the second positive lens facing the object.
45. The miniature objective of claim 32, wherein the diffractive surface is disposed on the back surface of the second positive lens facing the image.
46. The miniature objective of claim 32, wherein the diffractive surface is disposed on the back surface of the third lens facing the image.
47. The miniature objective of claim 32, wherein the diffractive surface is disposed on the front surface of the fourth lens facing the object
48. The miniature objective of Claim 32, wherein a diffractive surface is disposed on the front surface of the second positive lens facing the object, the back surface of the second positive lens facing the image, the back surface of the third lens facing the image, or the front surface of the fourth lens facing the object, or combinations thereof.
49. The miniature objective of claim 32, the objective comprising at least two diffractive surfaces disposed on surfaces of lenses of said objective.
50. The miniature objective of claim 32, wherein each lens comprises a low-dispersion, crown-like material.

51. The miniature objective of claim 32, wherein the objective comprises no more than four lenses.

52. The miniature objective of claim 32, wherein distortion is maintained at less than 0.5% at an all field position.